

Data Manipulation

Arithmetic Operators

Arithmetic Operators

Addition and Subtraction

| Problem in base 10 | | Problem in two's complement | | Answer in base 10 |
|--------------------|--|-----------------------------|--|-------------------|
|--------------------|--|-----------------------------|--|-------------------|

| | | | | |
|---|---|--|---|---|
| $\begin{array}{r} 3 \\ + 2 \\ \hline \end{array}$ | → | $\begin{array}{r} 0011 \\ + 0010 \\ \hline 0101 \end{array}$ | → | 5 |
|---|---|--|---|---|

| | | | | |
|---|---|--|---|----|
| $\begin{array}{r} -3 \\ + -2 \\ \hline \end{array}$ | → | $\begin{array}{r} 1101 \\ + 1110 \\ \hline 1011 \end{array}$ | → | -5 |
|---|---|--|---|----|

| | | | | |
|--|---|--|---|---|
| $\begin{array}{r} 7 \\ + -5 \\ \hline \end{array}$ | → | $\begin{array}{r} 0111 \\ + 1011 \\ \hline 0010 \end{array}$ | → | 2 |
|--|---|--|---|---|

Subtraction can be simulated by addition and negation like in 2's complement notation 7 - 5 would be 7 + (-5) which means the binary of 7 will be added to binary of -5

Arithmetic Operators

Multiplication

- ✓ Multiplication is repetitive addition
- ✓ For example 8 multiplied by 3, we will add 8 three times

Arithmetic Operators

Division

- ✓ Can be achieved through subtraction
- ✓ 15-5
- ✓ Some small CPUs are designed to have just add, or just add and subtract to do all arithmetic operations.

Arithmetic Operators

Remember

- ✓ If it ~~addition~~ has 2's complement, it is straight forward
- ✓ If its save in floating point notation, then you know you need to use mantissa, exponent and sign bit.
- ✓ Although both are additions but both have different workout.

Summary

Arithmetic Operations

- ✓ Addition and subtraction
- ✓ Multiplication is repetitive addition
- ✓ Division is repetitive subtraction
- ✓ Remember how the data was stored.